A BAIT TRAP FOR SAMPLING THE FEEDING POPULATIONS OF BLOOD-SUCKING DIPTERA ON CATTLE

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A bait trap for sampling the feeding populations of blood-sucking flies in the field was designed. Using this trap, four species of Simuliidae, six of Culicidae, two of Ceratopogonidae, and seven of Tabanidae were identified as feeding on cattle in central Alberta. The seasonal occurrence of the feeding and non-feeding populations of blood-sucking flies as sampled by this trap is discussed briefly.

Nous décrivons un piège appâté pour échantillionner en nature les populations de diptères piqueurs se nourrissant activement. A l'aide de ce piège, nous avons reconnu quatre espèces de Simuliides, six de Cluicides, deux de Ceratopogonides, et sept de Tabanides attaquant le bétail dans le centre de l'Alberta. Nous discutons brièvement la distribution saisonnière des populations de ces insectes pour les périodes d'alimentation et de jeune.

INTRODUCTION

Biting flies in central and northern Alberta are abundant and are serious pests of livestock and man. The black fly *Simulium arcticum* Malloch, particularly, is a serious pest of cattle and is a limiting factor in the production of livestock in central Alberta (Fredeen 1977). An accurate knowledge of the feeding habits of black flies is essential before protective measures such as the use of repellents or pesticides can be evaluated. *S. arcticum* feeds almost entirely on cattle, thus making it difficult to sample the populations feeding on cattle with the stationary bait traps described by Hudson and Gooding (1977), Roberts (1965), Service (1976, 1977), and Southwood (1966). This species does not enter partly shaded buildings or shelters readily and, when it does enter a building or shelter, it does not bite the animals readily. A trap for sampling feeding populations of biting flies with particular reference to *S. arcticum* is described here with a list of the other blood-sucking flies collected with the trap.

MATERIALS AND METHODS

Description of Trap

Walls, ceiling, and floor were constructed as separate sections that could be bolted together, permitting easy assembly, dismantling, and transporting of the trap. The structural plan is shown in Figure 1.

Frames for walls and ceiling were made of fir wood (dimensions given in Fig. 1) and covered with nylon screening with a mesh-opening of 0.6 x 0.6 mm. The screen on the ceiling was permanently fastened to the frame of the ceiling. The screen on the walls was permanently fastened only to the top edge of the frame and could be flipped onto the ceiling of the trap when the latter was in open (Fig. 2). Velcro zipper, fastened with Velcro cement, was used to fasten screens to frames of the walls so that the trap could be closed quickly.

The floor was constructed of fir plywood, 2.5 cm thick, and was hinged along the middle so that it could be folded for transport or storage. The floor was painted white for easy detection of small insects falling or settling on the floor.

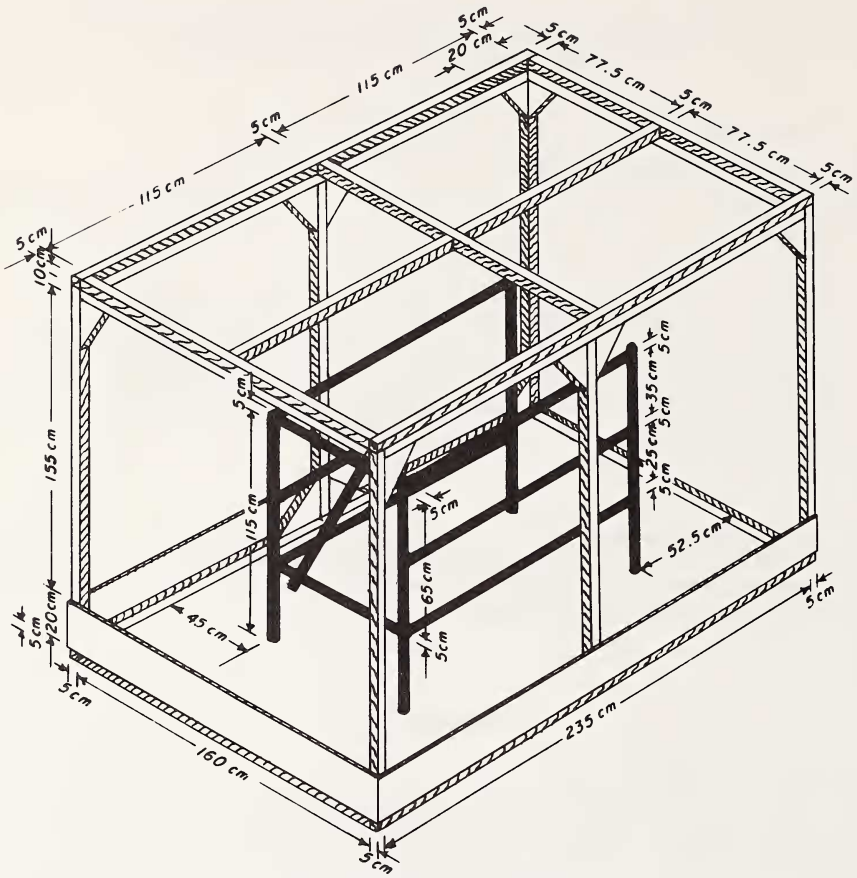

Fig. 1. Structural plan of a trap used to sample the feeding populations of biting flies. Nylon screen on the walls and ceiling excluded.

A stanchion (Fig. 1 and 2), constructed from 5 cm metal pipe (Fig. 1) in three sections (two sides and a head restrainer), was bolted to the floor in the middle of the trap. Space was sufficient between stanchion and walls for collectors to walk around the stanchion to collect flies from walls and ceiling. The stanchion was large enough to hold a steer or heifer weighing 100–450 kg.

Bait Animals

Two one-year-old Aberdeen Angus steers, weighing about 300 kg were used one at a time as bait. These steers, uniform in body size, color, and texture of hair coat, were halter-broken and trained to enter the trap.

Collecting the Insects

The trap was set up in a pasture where flies were known to be present and the steers were exposed to natural populations of flies. After a steer had been led in and restrained in the stanchion, the walls were closed as quickly as possible. The trap was then kept closed for ten minutes, the minimum time required for insects feeding on the steer to detach and settle on the walls and ceiling before a collector entered (Fig. 3). Insects were collected either in vials (5- or 20 ml size), filled to the top with 70% ethanol into which the insects dropped as the

Fig. 2. Trap showing a steer in the stanchion with the walls of the trap on top of the ceiling.

bottle was placed over or behind the insect, or with a household vacuum cleaner fitted with a collecting bottle at the end of its hose. The vacuum cleaner was operated on electricity generated by a portable generator and was used only when populations were high. The vial method was used when the insect populations were low and was the preferred method as it caused minimal damage to the insects.

Between collections, the walls of the trap were flipped onto the ceiling to prevent trapping free-flying, blood-sucking flies or other miscellaneous insects.

The blood-sucking insects were identified, counted, and their feeding state determined in the laboratory. Only blood-fed females were regarded as members of the feeding populations.

RESULTS AND DISCUSSION

From June 18 to August 21, 1974, 75 collections of blood-sucking Diptera were made in the bait trap near Athabasca, Alberta. The number of blood-fed females in the samples indicated that four species of black flies, *S. arcticum, S. venustum, S. vittatum,* and *S. decorum,*

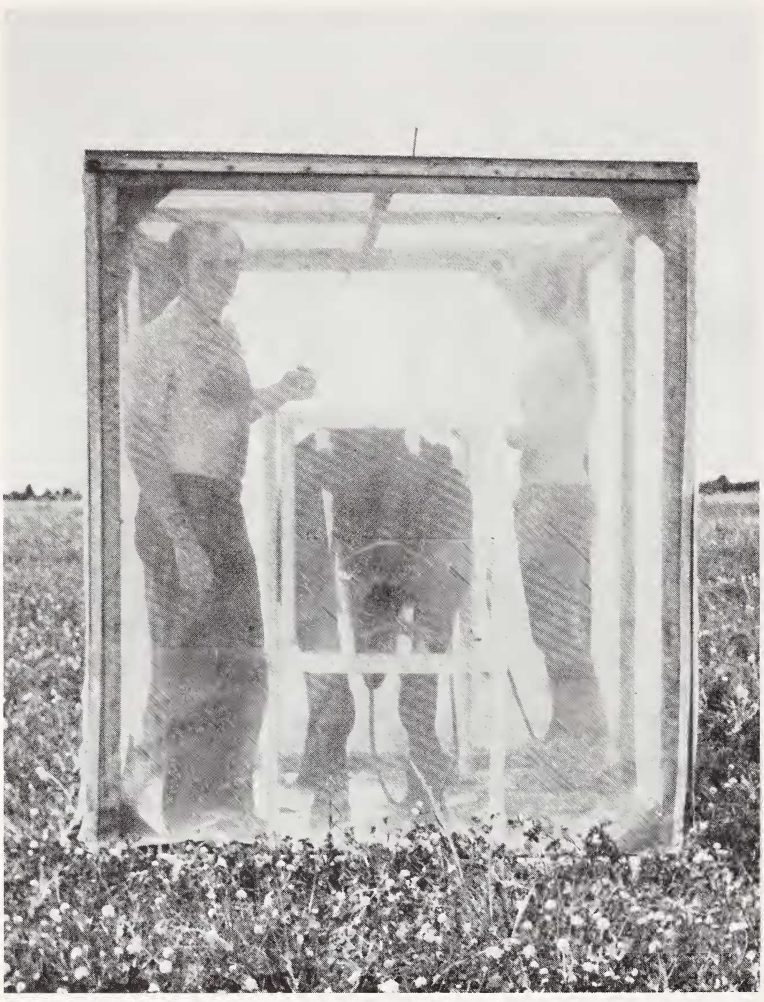

Fig. 3. The trap with the walls in place and collectors collecting the flies from the walls and ceiling.

fed on cattle in large numbers and were pests during the entire summer (Table 1). Furthermore, large numbers of black flies around cattle were not feeding, as indicated by non-blood-fed specimens in the samples. *S. arcticum* was the predominant species present.

Females of at least six species of mosquitoes, *Aedes vexans* (Meigen), *Aedes flavescens* (Müller), *Aedes fitchii* (Felt and Young), *Aedes excrucians* (Walker), *Aedes punctor* (Kirby), and *Culiseta inornata* (Williston), attack cattle in the Athabasca area (Table 2). Even though fewer mosquitoes than black flies were collected, data indicate that this trap could be used for sampling blood-feeding populations of mosquitoes. If the sampling had been conducted earlier, during the period from late April to the end of May, when the mosquito populations are normally high, a larger number of specimens and species might have been collected.

Adults of two species of Ceratopogonidae, *Culicoides yukonensis* (Hoffman) and *Culicoides obsoletus* (Meigen), were trapped (Table 3). Many females of *C. yukonensis* were around cattle during the entire sampling period but fewer *C. obsoletus* females were present, and only during the early part of the summer.

Adults of 11 species of Tabanidae were collected (Table 4). Females of at least seven of

these species fed on the steers, as indicated by the number of blood-fed flies.

Table 1. Average number of blood-fed (BF) and non-blood-fed (NBF) female black flies collected in the bait trap in 75 collections made from June 18–August 21, 1974.

		Number collected							
		S. arcticum		*S. venustum*		*S. vittatum*		*S. decorum*	
Date	Number of collections	BF	NBF	BF	NBF	BF	NBF	BF	NBF
June 18	7	43.6	54.0	37.7	57.3	0.4	2.3	0.1	0.4
July 3	5	128.4	107.6	42.2	72.4	18.8	56.0	0.2	0.6
July 4	6	39.0	48.8	19.3	26.0	8.3	26.7	0	0
July 10	9	51.1	82.7	1.1	2.6	5.0	12.6	0.1	0
July 11	2	165.0	204.0	38.0	49.0	2.0	7.0	0	0
July 14	5	86.0	137.8	7.8	16.4	10.4	18.4	0	0
July 23	7	25.4	31.7	3.6	6.3	6.9	9.6	0.4	0.6
July 26	7	5.0	7.1	1.3	2.0	0.6	0.4	0	0.3
July 30	5	135.4	317.0	2.6	15.6	4.8	11.4	0	0.2
July 31	6	329.5	497.5	5.0	10.8	8.3	12.2	1.2	4.8
August 9	6	279.5	422.0	3.8	7.3	19.8	47.5	0.3	0.3
August 12	3	804.0	1146.3	16.3	32.0	2.7	7.0	11.7	42.0
August 13	5	106.4	125.0	0.2	0.8	0	0	1.6	2.4
August 21	2	1116.5	1658.0	2.0	11.0	6.0	12.0	2.5	7.0

On the basis of the data for one trapping season, it is clear that this trap can be used to sample feeding populations of biting flies under field conditions in central Alberta. Even though some blood-engorged females have been observed to detach and drop off as the steer was led into the trap, significant numbers remained with the steers to give adequate samples for the measure of biting attack. In this study, no attempt was made to determine the numbers of blood-engorged flies that were lost through the disruptive effect of moving the animal. In this study, steers were used as bait but, with some modification to the stanchion, other animals such as horses, sheep, or goats could be used.

The use of this trap is envisaged in studies on seasonal, diel, and feeding activity of blood sucking flies under field conditions and an evaluation of repellents and pesticides for protection of livestock from blood-sucking fly attack.

Table 2. Number of blood-fed (BF) and non-blood-fed (NBF) female mosquitoes collected in the bait trap in 75 collections made from June 18 to August 21, 1974.

Date	Number of collections	*A. vexans*		*A. flavescens*		*A. fitchii*		*A. excrucians*		*A. punctor*		*C. inornata*	
		BF	NBF	BF	NBF	BF	NBF	BF	NBF	BF	NBF	BF	NBF
June 18	7	0	0	4	1	65	50	3	1	0	2	0	0
July 3	5	0	1	4	1	87	39	4	4	28	10	0	2
July 4	6	0	0	1	0	46	0	0	0	2	3	0	0
July 10	9	0	0	0	0	14	8	0	0	1	4	0	0
July 11	2	0	0	0	0	49	10	1	0	112	18	10	6
July 14	5	0	0	0	0	4	0	0	0	3	2	1	0
July 23	7	0	0	0	0	0	1	0	0	1	0	2	3
July 26	7	10	13	0	0	3	0	0	0	12	12	3	2
July 30	5	43	32	0	0	0	0	0	0	12	5	0	0
July 31	6	208	172	0	0	0	0	0	0	0	0	48	8
August 9	6	121	66	0	0	0	0	0	0	0	0	18	3
August 12	3	59	42	0	0	0	0	0	0	0	0	4	1
August 13	5	41	67	0	0	0	0	0	0	0	4	8	1
August 21	2	4	2	0	0	0	0	0	0	0	0	0	0

Table 3. Number of blood-fed (BF) and non-blood-fed (NBF) female Ceratopogonidae collected in the bait trap in 44 of 75 collections from June 18 to August 21, 1974.

Date	Number of collections	*C. yukonensis*		*C. obsoletus*	
		BF	NBF	BF	NBF
June 18	7	2	0	0	1
July 4	6	8	3	0	0
July 10	9	47	40	27	0
July 31	6	44	10	0	0
August 9	6	11	3	0	0
August 12	3	367	74	0	0
August 13	5	39	54	0	0
August 21	2	2	3	0	0

Table 4. Number of blood-fed (BF) and non-blood-fed (NBF) female Tabanidae collected in the bait trap in 75 collections made from June 18 to August 21, 1974.

Species	Feeding status	
	BF	NBF
Chrysops carbonarius Osten Sacken	0	1
Chrysops frigidus Osten Sacken	0	37
Chrysops furcatus Osten Sacken	15	53
Chrysops mitis Osten Sacken	2	3
Haematopota americana Osten Sacken	1	0
Hybomitra affinis (Kirby)	17	108
Hybomitra frontalis (Walker)	2	15
Hybomitra metabola (McDunnough)	0	11
Hybomitra lanifera (McDunnough)	2	30
Hybomitra lasiophthalma (Macquart)	1	0
Hybomitra nuda (McDunnough)	0	7

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REFERENCES

Fredeen, F.J.H. 1977. A review of the economic importance of black flies (Simuliidae) in Canada. Quaestiones Entomologicae 13: 219–229.

Hudson, J.E. and R.H. Gooding. 1977. Seasonal biology of *Culiseta inornata* and other mosquitoes in the Edmonton region. Report to the Minister of the Environment, Alberta. Mimeographed. 109 pp.

Roberts, R.H. 1965. A steer-baited trap for sampling insects affecting cattle. Mosquito News 25: 281–285.

Service, M.W. 1976. Mosquito ecology, field sampling methods. Halsted Press, John Wiley and Sons, New York and Toronto.

Service, M.W. 1977. Methods of sampling adult Simuliidae, with special reference to *Simulium damnosum* complex. Tropical Pest Bulletin 5, Hobbs Printers of Southampton. 48 pp.

Southwood, T.R.E. 1966. Ecological methods with particular reference to the study of insect populations. Methuen & Co., Ltd., London. 391 pp.